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An Enumeration of the Plants collected in Paraguay, 1888-1890, Annals N. Y. Acad. Sci. (1899-1893).

A Revision of the North American Naiadaceæ. Mem. Torr. Bot. Club, 3: Part. 2, pp. 65 (1893).

A new Species of *Listera* with notes on other Orchids. Bull. Torr. Bot. Club, 20: 31-39, 121, 122 (1893).

Thomas Hogg. Bull. Torr. Bot. Club, 20: 217, 218 (1893).

Notes upon various Species of Iridaceæ and other Orders. Bull. Torr. Bot. Club, 20: 467-473 (1893.)

Mr. Morong was a most diligent and painstaking worker. He systematically came to his post at eight o'clock in the morning and remained until two in the afternoon. After lunch he never failed to take his hour's *siesta*, a Paraguayan habit which he thoroughly enjoyed, and was back again at work from four until eight or often later. Personally he was a delightful man, always cheerful, usually gay, overflowing with interesting, instructive and amusing remarks, generous to a fault and constantly mindful of the feelings and wishes of others. His death has lost to American Science one of its most earnest, critical and enthusiastic devotees, and to those who have been favored with his companionship a dear friend, a wise adviser, a beloved associate.

A Revision of the Genus *Lechea*.

By N. L. BRITTON.

The genus *Lechea* was named by Kalm in 1751* in honor of John Leche, a Swedish botanist. Linnæus took it up in 1753, in the first edition of his "Species Plantarum," and there indicated two species, *L. minor* and *L. major*. His *Lechea major* proved to be a *Helianthemum*, thus leaving *L. minor* as the type of the genus. Michaux added several species in 1803. Spach discussed the order Cistaceæ in 1836, and in the same year appeared Rafinesque's monograph of the genus,† where twenty-one species

*Linnæus, Nova Pl. Gen. 10; Amœn. Acad. 3: 10.

†New Fl. N. A. 89-98 (1836); reprinted by Leggett in Bull. Torr. Bot. Club, 6: 246-252, with annotations.

are described. The genus was critically studied in the field and herbarium by Mr. Wm. H. Leggett for more than ten years prior to his death in 1882, but he published little concerning it, contenting himself for the most part with assigning provisional names to the forms which he thought should be maintained as species, and building up an immense collection of them from all parts of the country. From my intimate relations with Mr. Leggett I naturally took much interest in the plants, and upon his death all his material came into my possession. We had together pored over Rafinesque's monograph, endeavoring to determine which of his names belonged to the forms we could recognize as distinct, and had come to the conclusion that, unless the type specimens could be found, there could be no certainty in using any of them. I have, therefore, endeavored in recent years to ascertain if these types are in existence, but I have been quite unable to find in any of the herbaria of Europe or America a single authentic *Lechea* of Rafinesque. Durand's herbarium at the Jardin des Plantes, Paris, contains many of Rafinesque's plants, and the Delessert herbarium at Geneva many more, but I could find none of the *Lecheas*. Dr. Torrey had a good deal of material from him, but nothing of the genus. The collections of the Botanical Garden at Palermo, Italy, where some of Rafinesque's material was doubtless deposited, were burned some years ago, as Dr. Geo. G. Kennedy ascertained for me on his recent trip to the Mediterranean. Still Rafinesque expressly remarks that he had specimens of all his described species, and they may still turn up somewhere. If they do, some modifications of the names adopted in this paper will doubtless become necessary.

The species so closely resemble each other that the brief characterizations of Linnæus, Michaux and Rafinesque are altogether inadequate to distinguish them, and I have been compelled to examine the type specimens in order to understand what authors have had in hand and reject the names of Rafinesque on account of my inability to correlate them with the species recognized by Leggett. This paper is, then, essentially based on the examination of type specimens. The results of Leggett's study of Rafinesque's monograph may be found by those interested in the BULLETIN, as above cited.

All the *Lecheas* which I have been able to examine in the field bloom very shyly, and the whole plant appears to come into flower at the same time. This occurs in bright sunshine, the petals are fugacious, and thus the flowers are of but little practical value in classification. The characters of the capsules and sepals seem to be constant, as are those of the leaves, both of the sterile, radical shoots and those of the stem and branches. The radical shoots appear in summer, apparently always after the time of flowering, and their leaves reach full development in autumn and early winter. The time to study the plants then, from a systematic standpoint, is in the late autumn.

The following key may serve as an aid to their rapid determination:

Placentæ of the capsule fragile, separating from the thin dissepiments, their margins revolute.

Leaves of the radical shoots oblong or ovate, not more than about three times as long as wide.

Outer sepals longer than the inner; inflorescence leafy.

1. *L. minor*.

Outer sepals equalling or shorter than the inner.

Capsule oblong; pedicels slender, 2-4 mm. long.

2. *L. racemulosa*.

Capsule globose; pedicels about 1 mm. long.

Erect; stem leaves large.

3. *L. villosa*.

Divaricately branched; stem leaves small.

4. *L. divaricata*.

Bushy-branched, tomentose-canescens.

5. *L. maritima*.

Leaves of the radical shoots lanceolate or linear, more than three times as long as wide.

Stem leaves narrowly linear; inner sepals 1-nerved.

6. *L. tenuifolia*.

Stem leaves filiform; Cuban.

7. *L. Cubensis*.

Stem leaves linear or linear-oblong; inner sepals 3-nerved.

Capsule 1 mm. in diameter; branches widely spreading or ascending.

8. *L. patula*.

Capsule 1.5 mm. in diameter.

Plant pale, canescent; branches nearly erect.

9. *L. stricta*.

Plants green; leaves glabrate; branches ascending.

Calyx densely covered with appressed, white hairs.

10. *L. Torreyi*.

Calyx merely strigose-pubescent.

11. *L. Leggettii*.

Capsule 2-2.5 mm. in diameter.

Outer sepals longer than the inner.

12. *L. tripetala*.

Outer sepals not longer than the inner.

13. *L. intermedia*.

Placentæ crustaceous, the margins not revolute, dissepiments persistent; pedicels deflexed.

14. *L. Drummondii*.

Descriptions of the Species.**I. LECHEA MINOR L.**

Lechea minor L. Sp. Pl. 90 (1753). (Type in Linnæan Herbarium.)

Lechea thymifolia Michx. Fl. Bor. Am. 1: 77 (1803). (Type in Michaux Herbarium.)

Lechea Novæ-Cæsareæ Austin; A. Gray, Man. Ed. 5, 81 (1867). (Type in Columbia College Herbarium.)

Erect, 1.5–6 dm. high, freely branching above, more or less pilose-pubescent with slightly spreading hairs throughout. Branches slender, erect, ascending or the lower sometimes spreading; stem-leaves oval or oblong, 8–15 mm. long, 4–7 mm. wide, subacute or obtuse, ciliate, the upper smaller; petioles 1–2 mm. long; leaves of the radical shoots oval or oblong, obtuse, 6–10 mm. long, 5–6 mm. wide; panicle usually very leafy; flowers close together, somewhat secund; outer sepals longer than the inner and mostly exceeding the obovoid or globose capsule.

Occurs in dry fields and thickets, Eastern Massachusetts to Florida, west to Michigan and Louisiana.

Much search has been necessary in order to determine which of the forms should be regarded as the true *L. minor*. The species is badly mixed in the Linnæan herbarium. There are two sheets so marked. The first bears a fruiting specimen of the plant above described, with mature radical leaves, as well as the upper part of a fruiting plant of what I take up as *L. villosa* Ell., together with two specimens of mature, radical shoots of the same. The second sheet carries an immature specimen of *L. maritima* Leggett, marked by Sir J. E. Smith "racemulosa Michx." Pinned to this sheet is another, bearing a plant too young for satisfactory determination, marked "eadem" by Smith, not marked by Linnæus.

There are also two sheets not marked by Linnæus. One of them has a specimen of a very young plant of a specimen marked "racemulosa Michx," by Smith; the other carries specimens of what I here take as the true *L. minor*, and evidently the type of the second synonym given by Linnæus in the "Species Plantarum," as it is labeled "Capraria fol. integerrimis, fl. virg."

It will thus be seen that not a bit of the plant which appears as *L. minor* L. in current American text-books entered into the original description of the species.

Sir J. E. Smith apparently regarded the species which I take up as *L. villosa* Ell. (*L. major* Michx., not L.) as the true *L. minor*, and previously to my examination of the Linnæan types I had taken this view, and it so appears in my Catalogue of Plants found in New Jersey. But I was unable to trace this to any of the synonyms cited by Linnæus, and while it is clearly a part of the original, it seems to me that the name more properly belongs to the species as characterized above.

2. LECHEA RACEMULOSA Michx.

Lechea racemulosa Michx. Fl. Bor. Am. 1: 77 (1803). (Type in Michaux Herbarium).

Erect, 1.5–4.5 dm. high, freely branching above, slightly pilose-pubescent throughout with appressed hairs. Branches slender, divergent or ascending; leaves of the stem oblong or linear-oblong, obtuse or subacute, narrowed at the base, 8–20 mm. long, 3–4 mm. wide; leaves of the radical shoots oval or oblong, 4–8 mm. long, 3–6 mm. wide, obtuse; petioles about 2 mm. long; panicle sparsely leafy; flowers oblong on slender, divergent pedicels 2–4 mm. long; outer sepals equaling or shorter than the inner; capsule ellipsoid.

In dry, sandy and rocky soil, Martha's Vineyard to South Carolina, west to Indiana and Tennessee.

3. LECHEA VILLOSA Ell.

Lechea major Michx. Fl. Bor. Am. 1: 76 (1803), not L. (Type in Michaux Herbarium.)

Lechea villosa Ell. Bot. S. C. & Ga. 1: 184 (1817). (Type in Elliott Herbarium.)

Erect, stout, villous-pubescent with spreading hairs, 3–6 dm. tall, branching above or sometimes throughout, leafy. Branches ascending or the lower sometimes spreading; leaves of the stem oblong-elliptic, obtuse but pointed, $1\frac{1}{2}$ – $2\frac{1}{2}$ cm. long, 6–10 mm. wide; petioles 1 mm. long; leaves of the radical shoots broadly oblong, obtuse, 6–8 mm. long, 4–6 mm. wide; ultimate branchlets often recurved; pedicels 1 mm. long; flowers more or less secund-scorpoid, close together; outer sepals about equaling the inner; capsule depressed-globose, 1 mm. in diameter.

In dry fields, Massachusetts to Florida, west to Southern Ontario, Illinois and Texas.

4. *LECHEA DIVARICATA* Shuttlw.

Erect, divaricately branched, branches slender, very leafy, densely villous-pubescent. Leaves of the stem and branches small, 4–8 mm. long, oval, oblong or linear-oblong, acute, clothed with spreading hairs on both surfaces; inflorescence very leafy; flowers obovoid; pedicels about 2 mm. long, not secund; outer sepals shorter than the inner; capsule globose, nearly 2 mm. in diameter.

Florida (Rugel, Garber, Curtiss), Texas (E. Palmer, No. 2025).

Distributed under the above name by Shuttleworth from Rugel's Florida collections, but apparently here first described. I have not seen the radical shoots and am consequently uncertain of the alliance of the species, but think there is little doubt of its near relationship to *L. villosa*.

5. *LECHEA MARITIMA* Leggett.

Lechea thymifolia Pursh, Fl. Am. Sept. 91 (1814), not Michx. (Type in the Kew Herbarium.)

Lechea maritima Leggett; Britton, Prel. Cat. N. J. 13 (1881). (Type in Columbia College Herbarium.)

Lechea minor var. *maritima* A. Gray, Man. Ed. 6, 77 (1890). (Type in Gray Herbarium.)

Densely tufted, branching from the base, stout, rigid, 1.5–3 dm. tall, tomentose-canescens with whitish hairs. Primary branches spreading or ascending, numerous; flowering branches slender, divergent, elongated; leaves of the stem linear or linear-oblong, obtuse or acute, 8–20 mm. long, 2–4 mm. wide; leaves of the radical shoots oblong or ovate-oblong, 6–8 mm. long, 3–5 mm. wide, densely canescent; pedicels 1 mm. long; flowers densely clustered; outer sepals slightly shorter than the inner; capsule globose, 1 mm. in diameter.

In sands of the sea-shore and in sandy pine barrens, Massachusetts to Georgia. Apparently also at the Crawford Notch, White Mountains of New Hampshire.

The radical shoots of this species do not begin to form until late autumn and are not fully developed until December.

6. *LECHEA TENUIFOLIA* Michx.

Lechea minor var. γ T. & G. Fl. N. A. 1: 154 (1838). (Type in Columbia College Herbarium.)

Lechea tenuifolia Michx. Fl. Bor. Am. 1: 77 (1803). (Type in Michaux Herbarium.)

Lechea thesioides Spach, Comp. Bot. Mag. 1: 284 (1835). (Type in Paris Herbarium.)

Densely tufted, stems erect, slender, 1–2.5 dm. high, divaricately branched above, minutely strigose-pubescent. Branches slender, elongated; leaves of the stem narrowly linear or nearly filiform, 4–15 mm. long, 1 mm. or less wide, acute, sessile, or very nearly so; leaves of the radical shoots linear, sessile, 6–8 mm. long, about 1 mm. wide; pedicels 2 mm. long; flowers more or less secund, bracted by the minute upper leaves; outer sepals equalling or slightly exceeding the inner; capsule globose, 1 mm. or a little more in diameter.

In dry, open places, Eastern Massachusetts to Wisconsin, south to Florida and Texas.

7. *LECHEA CUBENSIS* Leggett.

Lechea Cubensis Leggett, Bull. Torr. Club, 6: 252 (1878). Type in Columbia College Herbarium.)

Erect, branched, 1–1½ dm. high, finely appressed-pubescent throughout, the branches filiform, ascending. Leaves of the stem and branches filiform, 4–8 mm. long, scarcely 0.5 mm. wide; flowers oblong, not secund; pedicels filiform, 4–6 mm. long; outer sepals slightly shorter than the inner; capsule globose, about 1 mm. in diameter.

Cuba (C. Wright, No. 3518).

This interesting species, known to me only from one collection, is placed next to *L. tenuifolia*, but the material for examination is too meagre to afford a satisfactory diagnosis. It is certainly distinct from any of the rest. Its radical shoots are unknown.

8. *LECHEA PATULA* Leggett.

Lechea patula Leggett, Bull. Torr. Club, 6: 251 (1878). (Type in Columbia College Herbarium).

Bushy, usually divergently branched, but branches sometimes ascending, appressed-pubescent, 1.5–4.5 dm. high. Leaves of the stem and branches linear or oblong, acute, 4–9 mm. long, 1 mm. or less wide; leaves of the radical shoots canescent, linear-oblong or somewhat spatulate, subacute, 6–10 mm. long, 1–2 mm. wide; flowers minute, globose; outer sepals about equalling the inner; capsule globose, 1 mm. in diameter.

Florida and South Carolina.

This was distributed by Shuttleworth from Rugel's collections as *L. nana*.

9. *LECHEA STRICTA* Leggett.

Erect, strict, 3–5 dm. tall, densely branched, pale, strigose-canescens all over or more glabrate in age. Branches slender, straight, nearly erect; leaves of the stem linear-oblong, 1–2.5 cm. long, 1–2 mm. wide, acute or subobtuse; leaves of the radical shoots linear-oblong, much smaller than those of the stem, 4–7 mm. long, 1 mm. or less wide, acute; pedicels 2–3 mm. long; outer sepals shorter than or equalling the inner; capsule globose, 1.5 mm. in diameter.

On dry prairies, Illinois, Wisconsin and Iowa.

10. *LECHEA TORREYI* Leggett.

Lechea Torreyi Leggett; S. Wats. Bibl. Index, 1: 81 (1878). (Types in Columbia College Herbarium.)

Lechea racemulosa Hook. Journ. Bot. 1: 193 (1834), name only, not Michx.

Cinereous-pubescent, much branched, 2.5–4.5 dm. high, the branches ascending. Leaves of the stem and branches linear, 8–12 mm. long, about 2 mm. wide, acute, those of the radical shoots smaller and narrower, finely appressed-pubescent; flowers numerous, short-pedicelled; calyx densely covered with appressed white hairs; capsule obovoid or subglobose, 1.5 mm. in diameter; outer sepals shorter than the inner.

Florida and South Carolina.

11. *LECHEA LEGGETTII* Britt. & Holl.

Lechea minor Lam. Tabl. Encycl. t. 52, f. 1 (1791), not L.

Lechea Leggettii Britt. & Holl. Prel. Cat. N. Y. 6 (1888). (Types in Columbia College Herbarium.)

Lechea Leggettii var. *pulchella* Britt. & Holl. Prel. Cat. N. Y. 6 (1888).

Erect, rather slender, freely branched, somewhat strigose-pubescent or nearly glabrous, 2.5–5 dm. tall. Branches slender, spreading or ascending; leaves of the stem linear or linear-oblong, acute or obtuse, 1–2.5 cm. long, 1–2 mm. wide, sessile or nearly so; leaves of the radical shoots oblong-linear, 4–6 mm. long, 1 mm. wide, acute; panicle open, its slender branches divergent; flowers somewhat secund; pedicels 1–2 mm. long; outer sepals about equalling the inner; capsule obovoid or subglobose, 1.5 mm. in diameter.

In dry soil, Long Island, N. Y., to Indiana, south to Virginia and Pennsylvania.

The nearest affinity of this species is with the preceding, with which I have sometimes thought of uniting it. It was distributed as *L. Torreyi* in Mr. Heller's Virginia collections of 1893.

12. *LECHEA TRIPETALA* (Moc. & Sesse).

Helianthemum tripetalum Moc. & Sesse; D.C. Prodr. 1: 284 (1824). (Founded on unpublished plate of Mocino and Sesse).

Lechea Skinneri Benth. Bot. Voy. Sulph. 99 (1844). (Type in Kew Herbarium.)

Low, 7–15 cm. high, much branched, clothed with long, whitish, appressed hairs. Leaves of the stem and branches filiform or linear, acutish, 8–10 mm. long, mm. or less wide; "leaves of the radical shoots narrower, appressed-canescens with long hairs;" flowers short-pedicelled; outer sepals subulate, longer than the inner, all densely pubescent; capsule depressed-globose, 2–2.5 mm. in diameter.

Guatemala (Skinner); San Luis Potosi (Parry and Palmer, No. 31); near Guadalajara, Jalisco (Pringle, No. 4496).

13. *LECHEA INTERMEDIA* Leggett.

Lechea Leggettii var. *intermedia* Britt. & Holl. Prel. Cat. N. Y. 6 (1888), name only.

Erect, strict, 2–5 dm. tall, branching above, sparingly strigose-pubescent. Branches nearly erect, short, slender; leaves of the stem oblong-linear, 1–2 cm. long, 2–3 mm. wide, acute, nearly sessile; leaves of the radical shoots oblong-linear, shorter than those of the stem, 8–10 mm. long, 1 mm. wide, somewhat larger than those of *L. Leggettii*; pedicels 2–4 mm. long, slender; outer sepals not longer than the inner; capsule globose or depressed-globose, 2 mm. in diameter.

In dry, mostly rocky soil, New Brunswick and Ontario to Pennsylvania.

This very well marked species is almost confined to hilly or mountainous districts. Its radical shoots are mature in November.

14. *LECHEA DRUMMONDII* (Spach) T. & G.

Lecidium Drummondii Spach, Comp. Bot. Mag. 1: 287 (1835). (Type in the Paris Herbarium.)

Lechea Drummondii T. & G. Fl. N. A. 1: 154 (1838). (Type in Columbia College Herbarium.)

Linum Sansabeanum Buckl. Proc. Acad. Phila. 1861, 450 (1861), according to Gray.

Sparingly pubescent, 1–2 dm. high, stems slender, wiry, much branched, decumbent or erect, the branches ascending. Leaves narrowly linear, 6–12 mm. long, 0.5 mm. wide, scattered, the upper minute; flowers solitary in the axils of the subulate upper leaves, second, slender-pedicelled, the pedicels deflexed and 2–4 mm. long in fruit; calyx strigose-pubescent, the outer sepals about as long as the inner; capsule depressed-globose, 2 mm. in diameter.

Texas (Drummond, No. 19; Wright; Lindheimer, No. 16; Berlandier, Nos. 631, 1028, 2041, 2458; E. Hall, No. 31; Curtiss' N. A. Plants, No. 232; Sabine River, Leavenworth).

Fossil *Salvinias*, including Description of a new Species.

BY ARTHUR HOLLICK.

(PLATE 205.)

The genus *Salvinia* is represented in the flora of to-day by thirteen recognized species, which are, with the single exception of *S. natans* (L.) All., confined to tropical regions. This latter species is well known in Europe and Asia, and has been found or reported from four localities in North America, viz.: Western New York and Missouri (*vide* Gray's Manual, 6th Ed., 701 [1890]); Minnesota (Conway MacMillan, Bull. Torr. Bot. Club, 18: 13 [1891]); Southeastern New York (Thos. Craig, Proc. Nat. Sci. Assn. S. I., Oct. 14, 1893). In all these localities, however, the indications are that the plant was introduced, and that it is not native on this continent.

In the fossil state the genus has been well identified from recent geological horizons—upper cretaceous and tertiary—in Europe and America, and thirteen species have been described.*

* 1. *Salvinia reticulata* (Ettingsh. in part), Heer, Fl. Tert. Helvetiæ, 3: (1859), 156, *pl.* 145, *f.* 16. (*Dalbergia reticulata* Ettingsh. Beitr. z. Kenntniss d. Foss. Fl. v. Tokay, Sitzb. d. K. Akad. Wiss. Wien, Math.-Nat. Cl. 11: (1853), 813, *pl.* 4, *f.* 5).

2. *Salvinia Mildeana* Goëpp. Tert. Fl. v. Schosnitz in Schlesien (1855), 5, *pl.* 1, *f.* 21–23; Unger, Syll. Pl. Foss (1860), 5, *pl.* 1, *f.* 7–10; Ettingshausen, Foss. Fl. d. Tert.-Beck. v. Bilin, Denkschr. d. K. Akad. d. Wiss. Wien, Math.-Nat. Cl. 26: (1866), 94, *pl.* 2, *f.* 23; Heer, Miocene Baltische Fl. (1869), 17, *pl.* 3, *f.* 1, 16, 2.